# Summary Version

## The Quantum View of the World EC. 8/1.1981

1.) Introduction (what is the basis of Quantum mechanics & basic assumptions, prerequisites — Tools examples.)

28th Aug. Times' Report: Random Events observer Einstein.

Denied an experiment by Aspect (Paris)

I want to tell you about the background to this experiment, and why the results are considered of 'Real importance.

(In fact so far Aspect has only performed a dummy run of his experiment the Times report is a bit premature)

2.) Atomic Structure (1a)

new laws replacing those of Newton (the planetary analogy)

3.) Quantum Mechanics

Two features

a) Quantization

b) Angular momentum (1b)

↳ Directional Quantization (1c)

2.) Probability distributions for possible measurement outcomes.

Ex: Hydrogen atom (2) - wave picture

(Perceived Quantization in the hydrogen atom (3))

4.) The Mathematical Problem

Can one always assign values to physical quantities which are then "measured"?

Two difficulties arise:

a.) Fock-Space Paradox

b.) Non-locality.

5.) The Fock-Space Paradox

red = 0, blue = 1. (4)

The 2-Colour Theorem. (5)

2-colour theorem in 2-dimensions (6)

2-colour theorem in 3-dimensions (7)
(Kochen-Conway-Specker)

(7) Non locality

The Bell experiment (8)

The Bell inequality (9)

The violation of the Bell inequality (10)

The 4 - correlation experiments (11)

The Locality principle (12)

7.) Aspect's Experiment (12a)

(frequency of communication 200 - 250 MHz. (INOS+HOYA)
Photons from source to switch ~ 3 metres
(so light takes $10^{-8}$ s from source to switch)

So needed, after clear photon is sent half-way from source to the switch

But note: The Bell inequality is not possible

8.) Interaction of photons + polarizer

Should photon be changed in its light of polarisation (13)

or should polarised photon be rotated in the light of new atoms in photon.

ie. Is exponential rotation possible?

9.) Concluding remarks

We may end up by rejecting one or other (or both) of two assumptions

1.) Atomic facts pertain independently of whether we are observing them, stated and recorded by observation

2.) Nonlocal effects underlying entanglement acting-at-a-distance is (according to relativity theory) impossible

Either Einstein was wrong about hidden variables or he was wrong about locality.

This is the sense in which we could truly say.

Random Events have shown Einstein.

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